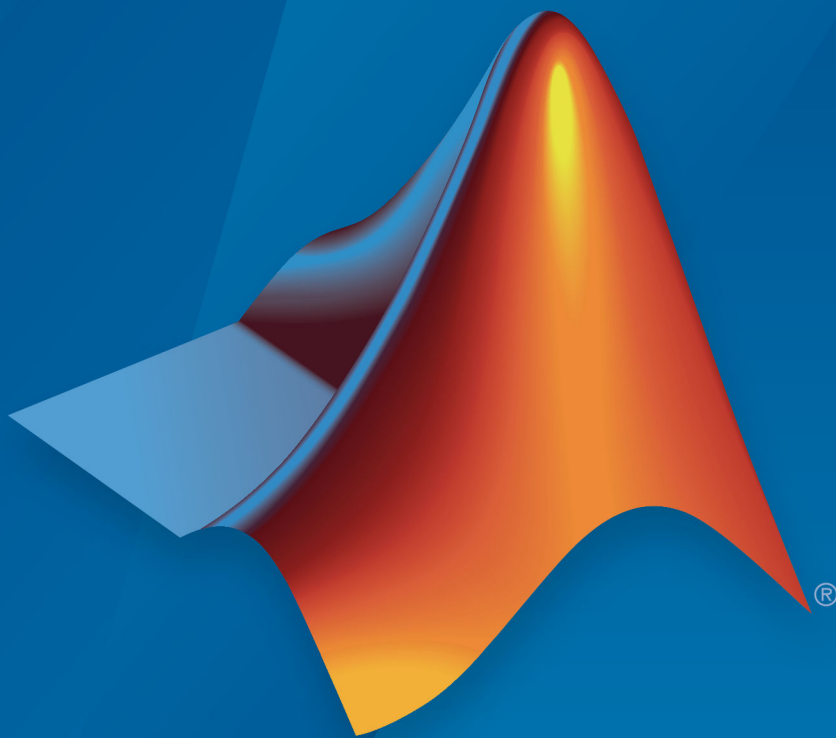


# 5G Toolbox™ Release Notes



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## *5G Toolbox™ Release Notes*

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# R2019a

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**Version: 1.1**

**New Features**

**Bug Fixes**

## Support for uplink physical channels PUSCH and PUCCH

Use these functions to model the physical uplink shared channel (PUSCH) and the physical uplink control channel (PUCCH) formats 0, 1, 2, 3, and 4.

New Feature	Description
nrPUSCH	Generate PUSCH modulation symbols
nrPUSCHCodebook	Generate PUSCH precoding matrix
nrPUSCHDecode	Decode PUSCH modulation symbols
nrPUSCHDescramble	Perform PUSCH descrambling
nrPUSCHPRBS	Generate PUSCH scrambling sequence
nrPUSCHScramble	Perform PUSCH scrambling
nrPUCCH0	Generate PUCCH format 0 modulation symbols
nrPUCCH1	Generate PUCCH format 1 modulation symbols
nrPUCCH2	Generate PUCCH format 2 modulation symbols
nrPUCCH3	Generate PUCCH format 3 modulation symbols
nrPUCCH4	Generate PUCCH format 4 modulation symbols
nrPUCCHPRBS	Generate PUCCH pseudorandom scrambling sequence
nrPUCCHHoppingInfo	Get PUCCH hopping information
nrLowPAPRS	Generate low peak-to-average power ratio (low-PAPR) sequence
nrTransformPrecode	Generate transform precoded symbols
nrTransformDeprecode	Generate transform deprecoded symbols

For more information, see “Uplink Physical Channels”.

## Support for uplink shared channel (UL-SCH) and uplink control information (UCI)

### UL-SCH

These functions and System objects support UL-SCH encoding and decoding.

New Feature	Description
nrULSCH	Apply UL-SCH encoder processing chain
nrULSCHDecoder	Apply UL-SCH decoder processing chain
nrULSCHInfo	Get uplink shared channel (UL-SCH) information

For more information, see “Uplink Transport Channels”.

### UCI

These functions support UCI encoding and decoding, including support for polar coding and channel coding of small block lengths.

New Feature	Description
nrUCIEncode	Encode uplink control information (UCI)
nrUCIDecode	Decode uplink control information (UCI)

For more information, see “Uplink Control Information”.

### Parity-check support for polar coding

Polar coding functions nrPolarEncode and nrPolarDecode now support parity-check polar coding.

## Addition of new downlink shared channel (DL-SCH) System objects

Use these System objects for DL-SCH encoding and decoding. These System objects replace the example-specific DL-SCH implementations in the previous release.

New Feature	Description
nrDLSCH	Apply DL-SCH encoder processing chain
nrDLSCHDecoder	Apply DL-SCH decoder processing chain

## 5G NR uplink waveform generation

You can now generate a 5G NR uplink waveform, including physical signals and channels. You can also parameterize and generate multiple bandwidth parts (BWP), and multiple

instances of the PUSCH and PUCCH channels over different BWPs. For an example, see “5G NR Uplink Carrier Waveform Generation”.

## **5G NR PUSCH link-level reference simulation**

You can measure the PUSCH throughput for various propagation conditions and parameter sets. For an example, see “NR PUSCH Throughput”.



# R2018b

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**Version: 1.0**

**New Features**

## **Introducing 5G Toolbox**

5G Toolbox provides standard-compliant functions and reference examples for the modeling, simulation, and verification of 5G communications systems. The toolbox supports link-level simulation, golden reference verification and conformance testing, and test waveform generation.

With the toolbox you can configure, simulate, measure, and analyze end-to-end communications links. You can modify or customize the toolbox functions and use them as reference models for implementing 5G systems and devices.

The toolbox provides reference examples to help you explore baseband specifications and simulate the effects of RF designs and interference sources on system performance. You can generate waveforms and customize test benches to verify that your designs, prototypes, and implementations comply with the 3GPP 5G New Radio (NR) standard.

## **Standard-compliant models for 3GPP 5G NR Release 15**

5G Toolbox provides standard-compliant functions and reference examples for the modeling, simulation, and verification of 5G communications systems. For more information, see Scope of 5G Toolbox.

## **Link-level simulation with reference examples, including 5G NR PDSCH throughput simulation**

5G Toolbox provides standard-compliant functions for end-to-end physical layer transmit and receive processing. You can measure the PDSCH throughput for various propagation conditions and parameter sets. For an example, see NR PDSCH Throughput.

## **OFDM waveform generation with NR subcarrier spacings and frame numerologies**

With 5G Toolbox, you can generate NR waveforms, including physical signals and channels. The process includes all the stages from channel coding to OFDM modulation. You can explore the effect of different subcarrier spacings and frame numerologies.

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## **TR 38.901 propagation channel models, including tapped delay line (TDL) and clustered delay line (CDL)**

5G Toolbox provides TDL and CDL channel modeling capabilities. For more details, see the `nrCDLChannel` and `nrTDLChannel` System objects.

## **Downlink transport and physical channels (shared, control, broadcast); synchronization and demodulation reference signals**

5G Toolbox provides functions to model transport and physical channels, including shared, control, and broadcast channels. You can also model synchronization and demodulation reference signals. For more information, see [Downlink Channels](#).

## **Signal processing functions, including channel coding (LDPC and polar codes), channel estimation, synchronization, and equalization**

5G Toolbox provides low-level functions that model subcomponents in the processing chain for transport channels, physical channels, and physical signals. For more information, see [Physical Layer Subcomponents](#). The toolbox also provides signal reception capability. Using 5G Toolbox functions, you can perform channel estimation, timing estimation, synchronization, and minimum mean-squared error (MMSE) equalization. For more information, see [Signal Reception](#).

## **C and C++ code generation support**

All 5G Toolbox functions and System objects support ANSI®/ISO® compliant C/C++ code generation.

